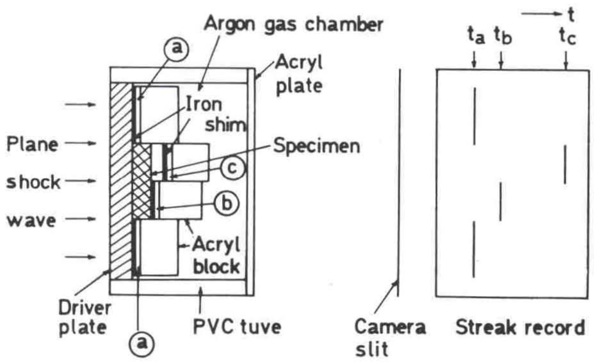

Fig. 7. Schematic view of the experimental set for measuring the shock and free surface velocities by means of the argon flash gap technique

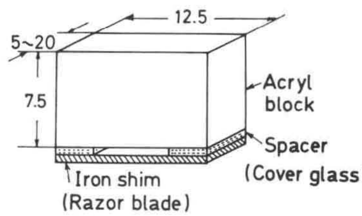

Fig. 8. Acrylite flash gap block (Dimension: mm)

by a thin glass spacer of 0.15 mm in thickness (a cover glass for optical microscopy). The incidence of the strong shock wave on the iron shim causes the gap to close, compressing and heating the gas to brilliant luminosity which is sufficient for exposure of the film in the streak camera as also illustrated in Fig. 7. The time of arrival of the shock wave on the surface of the driver plate, t_a, or that of the specimen, t_b, is detected with the argon flash gap labelled ⓐ or ⓑ, respectively. The shock velocity in the specimen can be calculated from $t_a - t_b$. The free surface velocity of the specimen is measured with the argon flash gap labelled ⓒ, which is positioned at a known distance from the free surface and becomes luminous at the time t_c. The accurate positioning of the acrylite block with a precision of 0.01 mm is performed using standard block gages as a spacer.

An example of streak records for the study on shock compression of Fe_3O_4[(9)] using both the in-contact method and the flyer method is shown in Fig. 9(a). A photograph of experimental sets used in a similar study on shock compression of GaP[(10)] is shown in Fig. 9(b). In each experiment, the planarity of the shock wave is monitored by three acrylite blocks located directly on the driver plate which becomes luminous at the time t_a. Three corresponding flash lines in each photographic record are quite straight for the in-contact run, whereas they are considerably curved for the flyer run. Other flash lines in the record correspond to the times t_b, t_c etc. These times must be corrected by taking the incomplete planarity into consideration. Broad flashes of light, which is clearly seen after the flash lines of argon gap in the record for the flyer run, are caused by the luminosity of argon gas behind the acrylite blocks which are moved by the collision of the specimen or the driver plate. In the record for the in-contact run, however, the broad flashes can scarcely be seen.

2) *Inclined mirror technique*

Since the argon flash gap technique provides only discrete information about

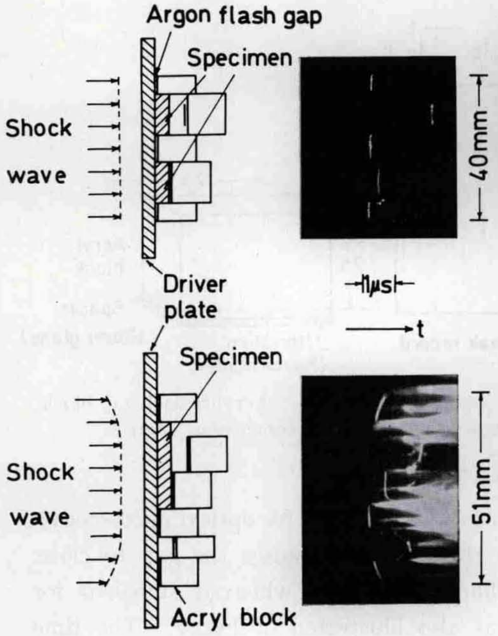

Fig. 9(a)

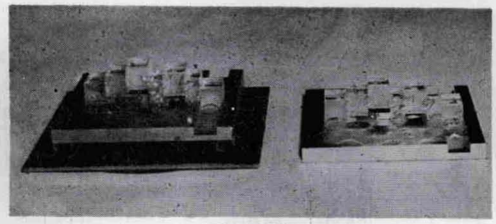

Fig. 9(b)

Fig. 9. Argon flash gap experimental sets and records
(a) Streak records (Specimen: Fe_3O_4)
Upper figure: in-contact method
Lower figure: flyer method
(b) Photograph of the experimental sets (Specimen: GaP)

time, its use is limited to cases where the free surface velocity is constant with time, i.e. the structure of shock wave is simple. A multiple shock wave such as the one resulting from phase transitions can be observed using another technique which allows the free surface motion to be monitored continuously. The inclined mirror technique(11), shown in Fig. 10(a), has been adopted as a simple continuous method.

This technique is based on the instantaneous change in reflectivity of a silvered glass mirror which takes place upon arrival of the shock wave. Some mirrors silvered on their inside surfaces are placed in contact with the driver plate or the specimen. Another mirror on the specimen surface is inclined at a small angle α. The assembly is illuminated by an intense light source such as a diffuse explosive argon candle and viewed through the slit of the streak camera. The sample chamber should be evacuated in order to avoid air shocks which perturb the mirror prior to the collision of the sample.

An example of the photographic record for the test sample of Fe is shown in Fig. 10(a). The arrival of the plane shock wave at the free surface of the sample is indicated by the decrease in intensity of the light reflected from the two mirrors in contact with the surface. A good planarity of the shock wave is clearly seen in the record. The free surface velocity of the sample is monitored by the point of collision of the sample with the inclined mirror, which is indicated by a trace of slanted image with an angle γ on the film. The free surface velocity is given by the following equation: